

3.1 Intro to Quadratic Relations

So far: Linear Relations	New: Quadratic Relations
Equation: $y = mx + b$	Equation: $y = ax^2 + bx + c$
➡ $m$ is slope, $b$ is y-intercept	$a$ , $b$ , and $c$ are coefficients
➡ highest exponent of $x$ is 1	highest exponent of $x$ is 2 (degree, or order, of 2)

Recall: To graph a relationship, we can use a table of values (or TOV).

1. Pick some values for  $x$  (some positive & negative)
2. Sub each  $x$ -value into the equation.
3. Determine values for  $y$ .
4. Plot each point  $(x, y)$  on the  $x$ - $y$  plane.

5. (Optional) Calculate first differences, which are the differences between *consecutive*  $y$ -values for *consecutive*  $x$ -values.

Create a TOV for  $y = 2x + 1$

x	$y = 2x + 1$	$\Delta y = y_2 - y_1$
-2	-3	
-1	-1	
0	1	
1	3	
2	5	

$$= 2(-2) + 1$$

$$= -4 + 1$$

$$= -3$$

$$= 2(-1) + 1$$

$$= -2 + 1$$

$$= -1$$

if 1<sup>st</sup> differences are constant it is linear

' $\Delta$ ' (delta) means "change in" or "difference".  $\Delta y$  is the change in y, or the first difference.

In a linear relationship, the first differences are constant.

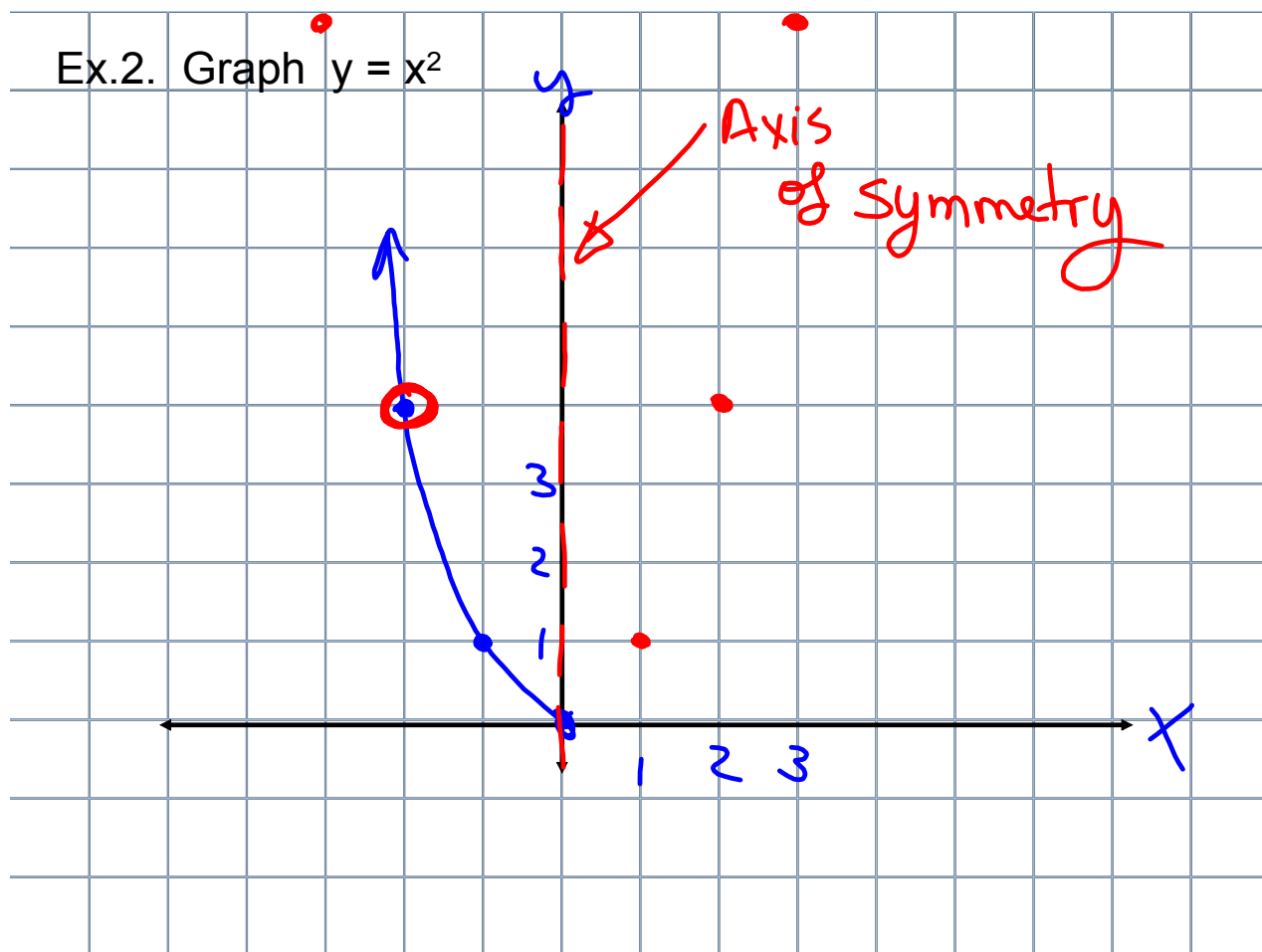
Ex.1. Create a TOV for  $y = x^2$

x	$y = x^2$	$\Delta y$ 1 <sup>st</sup>	$\Delta^2 y$ 2 <sup>nd</sup>
-2	4		
-1	1		
0	0		
1	1		
2	4		

$\Delta^2 y$  is the change in  $\Delta y$ , or change in 1st differences.

$\Delta^2 y$  is the second difference.

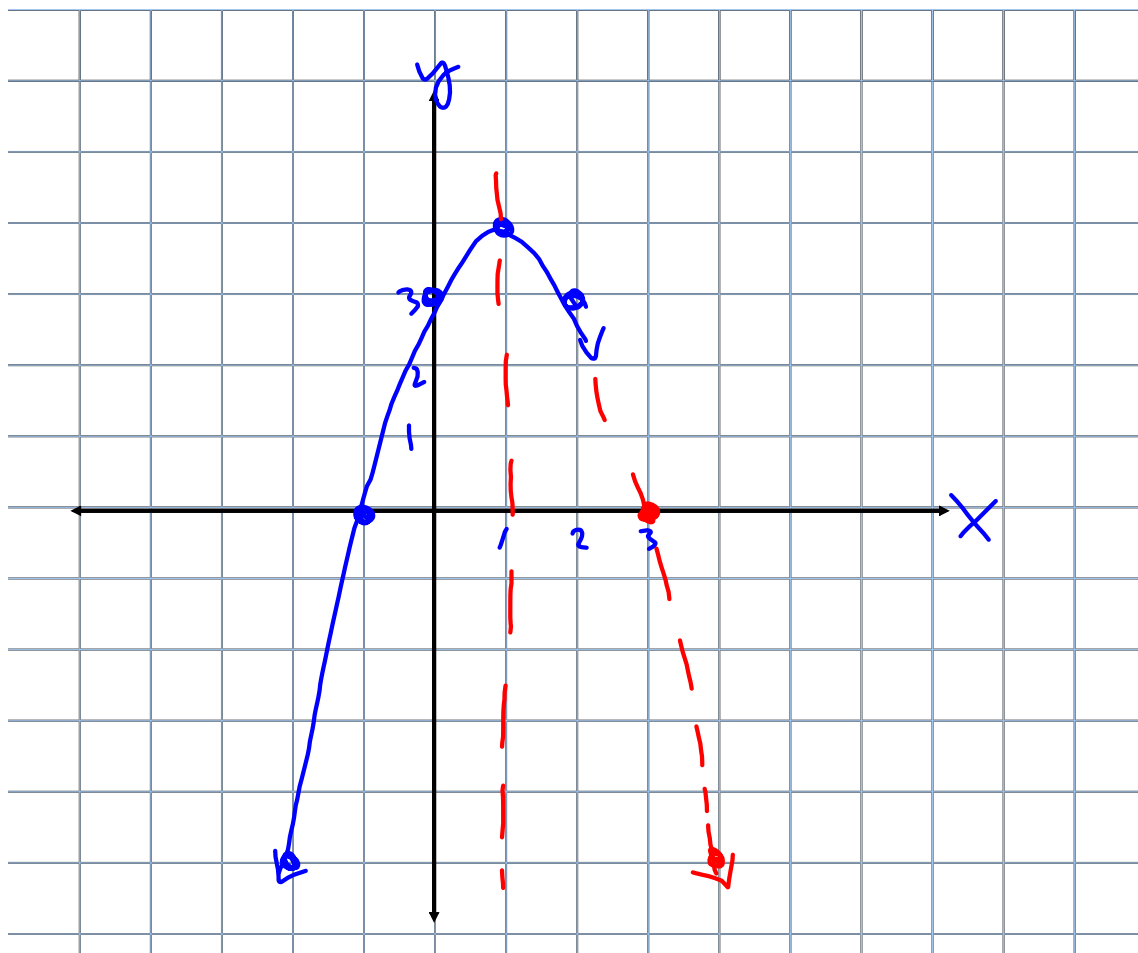
In a quadratic relationship, first differences are not constant and second differences are constant.

Ex.2. Graph  $y = x^2$ Ex.3. Create a TOV and graph  $y = -x^2 + 2x + 3$ .

x	$y = -x^2 + 2x + 3$	$\Delta y$	$\Delta^2 y$
-2	-5		
-1	0	$0 - (-5) = 5$	
0	3	$3 - (0) = 3$	$3 - (5) = -2$
1	4	$4 - (3) = 1$	$1 - (3) = -2$
2	3	$3 - (4) = -1$	$-1 - (1) = -2$

$= -(2)^2 + 2(2) + 3$

Constant Quadratic



For any parabola,  $y = ax^2 + bx + c$ , the direction of opening can be determined from:

- the graph
- the sign of the 2nd difference
- the sign of "a"

Positive "a" value  
Positive 2nd difference  $\Rightarrow$  parabola opens Up.

Negative "a" value  
Negative 2nd difference  $\Rightarrow$  parabola opens Down.

Assigned Work:

p. 137 # 1, 2, 3, 4, 5ab, 6, 7